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**LEVEL II**

FINAL REPORT FOR CHURCH STROKE II OCEANOGRAPHIC SERVICES

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26 March 1979

Final Report for Period 1 September 1977 - 31 October 1978

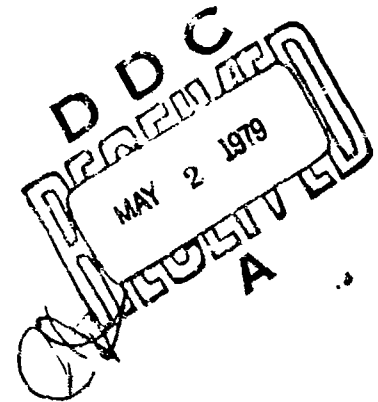
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# TABLE OF CONTENTS

Section	Title	Page
I	Introduction . . . . .	2
II	Technical Summary. . . . .	2
III	Preamplifier Calibration . . . . .	2
IV	Post-Operation Engineering Evaluation . . . . .	2
V	Summary . . . . .	6
VI	References . . . . .	6
	Appendix A PAR/ACODAC Diagnostic Plan. . . . .	7

# LIST OF ILLUSTRATIONS

Figure	Title	Page
1	Preamplifier Frequency Response: ACODAC 005 . . . . .	3
2	Preamplifier Frequency Response: PAR Unit 1 . . . . .	4
3	Preamplifier Frequency Response: PAR Unit 2 . . . . .	5

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## I. Introduction

This report describes the work performed by Texas Instruments under contract N00014-77-C-0776 during the period 1 September 1977 through 31 October 1978. Tasks performed under this contract include mobilizing and adapting the R/V Indian Seal for use as a test platform, conducting an at-sea calibration exercise and engineering evaluation, and performing an environmental acoustic measurement program in conjunction with the CHURCH STROKE II exercise.

## II. Technical Summary

The R/V Indian Seal was delivered to Texas Instruments at Port Hueneme, California. The ship was prepared as a platform for supporting an at-sea training and calibration exercise and an environmental acoustic measurement program using the PAR and ACODAC systems.

An at-sea calibration and training exercise was conducted off the Southern California coast during which two PAR systems were deployed and successfully recovered. Data gathered on these deployments revealed a problem existed with the gain settings of some of the preamplifiers on the arrays. The preamps were modified as a result of the test cruise.

The R/V Indian Seal transited from Port Hueneme to Guam. Two deployments of PAR and ACODAC systems were made in the Phillipine Sea as a part of an environmental acoustic measurement program in conjunction with the CHURCH STROKE II exercise. See Section VI for technical information documenting these exercises.

Following these deployments, the R/V Indian Seal returned to Galveston, Texas, where a derigging operation was conducted. Both PAR and ACODAC systems and their support equipment were returned to Texas Instruments where an engineering evaluation was performed on the systems.

## III. Preamplifier Calibration

A frequency response curve was drawn for the preamplifier on each data channel on which acoustic data was processed. The data for constructing these curves was gathered after the hydrophone-preamplifier units were returned to Texas Instruments at the conclusion of the CHURCH STROKE II exercises. All data was taken under the conditions of 00C temperature and atmospheric pressure.

The response data is presented in Figures 1-3.

## IV. Post-Operation Engineering Evaluation

Several hardware problems developed on the PAR and ACODAC systems during the CHURCH STROKE II deployments. An engineering evaluation was performed at Texas Instruments to determine the nature and extent of these problems. The results of this evaluation were incorporated into a diagnostic plan for use in preparing the systems for operation in future deployments. This plan is presented in Appendix A.

All Measurements in dB re 1 VRMS at 00c

Frequency	Tape Channel				
	4	10	11	12	13
1 Hz	49.5	42.5	42.1	41.8	41.8
2	50.0	42.3	42.4	42.4	42.2
5	49.8	42.3	42.4	42.4	42.2
10	49.8	42.3	42.4	42.5	42.2
20	49.8	42.2	42.4	42.4	42.2
50	49.8	42.2	42.3	42.4	42.2
100	49.6	42.2	42.2	42.3	42.2
200	49.3	41.9	41.9	42.1	41.7
300	49.1	41.4	41.5	41.6	41.2
500	47.8	40.4	40.3	40.5	39.8
800	45.6	38.4	38.3	38.7	37.7
1000	44.2	37.1	36.5	37.4	36.4

Figure 1. Preamplifier Frequency Response: ACODAC 005

All Measurements in dB re 1 VRMS at 00c

Frequency	Tape Channel			
	2	7	9	13
1 Hz	44.9	37.4	49.7	41.7
2	48.5	41.1	49.9	42.4
5	49.6	42.2	49.8	42.4
10	49.7	42.4	49.8	42.5
20	49.8	42.4	49.7	42.5
50	49.8	42.3	49.7	42.5
100	49.7	42.3	49.6	42.4
200	49.5	42.0	49.3	42.0
300	49.0	41.6	48.9	41.6
500	47.9	40.3	48.0	40.4
800	45.8	37.4	45.9	38.3
1000	44.4	37.4	44.0	37.0

Figure 2. Preamplifier Frequency Response: PAR Unit 1

All Measurements in dB re 1 VRMS at 00c

Frequency	Tape Channel					
	2	3	5	9	11	12
1	37.0	44.9	45.0	44.7	44.7	44.8
2	40.8	48.6	48.7	48.5	48.4	48.5
5	42.0	49.8	49.9	49.7	49.7	49.7
10	42.1	49.9	50.1	49.8	49.9	49.9
20	42.1	50.0	50.1	49.9	49.9	50.0
50	42.1	50.0	50.1	49.8	49.9	50.0
100	42.1	49.5	50.0	49.8	49.8	49.9
200	41.8	49.6	49.7	49.5	49.5	49.6
300	41.3	49.0	49.2	48.9	48.9	49.1
500	40.1	47.5	47.8	47.6	47.7	47.9
800	38.0	45.2	45.5	45.2	45.2	45.6
1000	36.8	43.6	44.0	43.6	43.6	44.2

Figure 3. Preamplifier Frequency Response: PAR Unit 2

## V. Summary

The mobilization and use of the R/V Indian Seal as a test platform for an at-sea calibration exercise and for an environmental acoustic measurement program was carried out under this contract. These tasks were performed in conjunction with the CHURCH STROKE II exercise. Also carried out under this contract was an engineering evaluation of the PAR and ACODAC systems.

## VI. References

The Operational Logs submitted under this contract contain technical information concerning the deployment of PAR and ACODAC systems in the Phillipine Sea.

Appendix A

PAR/ACODAC Diagnostic Plan

## A.1

### PAR Systems

#### 1. PAR Unit 2

- a. Unit 2 went into a "cycled" mode of operation during Phase 2 of CHURCH STROKE II. The data tape recorded during this deployment will be studied for evidence of the source of the problem. The system will be placed in an environmental chamber and the microprocessor loaded with the operational parameters used during the Phase 2 deployment. Attempts to recreate the problem will be attempted by simulating:
  - 1) low power on the battery
  - 2) bad connection between tape recorder and battery module
  - 3) water in the battery connector
  - 4) other situations which might be suggested by the above tests.

#### 2. Common Problems

- a. Data on unit 1 and unit 2 were overrecorded on both deployments of CHURCH STROKE II. This problem was traced to the sample and hold units. With a grounded input, the sample and hold units could not be adjusted to a 0 volt offset. The minimum offset was determined to be 300 mv. Identical problems existed in both systems. A test set will be built so that the units can be tested and adjusted independent of the PAR system. This test set can also be used as a tool to aid in adjusting the ADC and sample and hold devices in the field. If this system independent test is consistent with the results seen in the PAR systems, the devices will be sent to the repair department of Datel Systems Inc. for a failure analysis and repair. If repair is impossible, new sample and hold units will be purchased. The repaired or replaced unit will be inserted in the PAR system and then placed in an environmental chamber for testing under operating conditions.
- b. On both unit 1 and unit 2, status information from the PAR electronics is displayed erroneously on the monitor panel when the tape recorder is running. This is a problem on the Tape Recorder Control/Voltage Monitor board. It will be isolated and repaired using standard troubleshooting procedures.
- c. The differential input boards are known to be a problem point due to manufacturing defects. These boards will be remanufactured to correct the problem. The new boards will be placed in the system and tested to assure their reliability.

## ACODAC Systems

## 1. Common Problems

- a. All components in each system will be checked to determine if they meet specification required for reliable performance under operating conditions. Any substandard parts will be replaced. This task will be performed prior to any other testing or diagnostic work being done on the system.
- b. The support panel will be tested to verify that it functions properly. A problem has been observed in the time code generator; it cannot be reset to 0 days 0 hours 0 minutes 0 seconds. In addition, four hours are added to the time which is being set in the generator. This problem will be isolated and repaired. Additionally, the power supplied to the ACODAC systems by the panel will be checked for stability and level. This task will be performed prior to using the support panel to troubleshoot the systems.
- c. The telemetry systems on each ACODAC were not refurbished prior to the CHURCH STROKE II exercises. Using standard procedures these units will be tested and repaired as needed.
- d. In conjunction with items a, b, and c, a documentation package will be prepared to include a complete set of logic drawings of all electronic systems. Since serial number 002 and 005 are different modifications of the ACODAC, a unique documentation package is required on each system. The support panel and operation of the ACODAC units with the support panel will also be documented.

## 2. Unit 002

- a. The time code kept by this unit has been observed to lose about 3 seconds with respect to the support panel time code generator over a 16 hour period in laboratory tests. The support panel generator will be checked for accuracy. If it is found to be accurate, then the problem must lie in the ACODAC time code generator. This problem will then be found and eliminated using standard troubleshooting procedures.
- b. Tests on the gain ranging functions of each data amp in the laboratory have shown that 3 channels are not operating; they would not go to the lower gain states. The differential input board will be checked and eliminated as a source of error. Standard troubleshooting techniques will be used to repair the individual data amps. The trip point for each gain state will be experimentally determined and documented.

### 3. Unit 005

- a. The time code could not be initialized in this unit. The gain ranging electronics also failed to function on all channels. The probable source of failure is the loss of power to the logic boards. This problem will be isolated using standard troubleshooting procedures. Once repaired the time code will be checked for accuracy. The gain ranging function will be checked and trip points accurately determined and documented.

#### A.3

##### Tape Recorder Drive Belt

Both the PAR and the ACODAC systems have experienced problems in the past with drive belts on the tape recorder breaking. It has recently been observed that an alignment problem between the tape recorder motor pulley and the capstan drive pulley causes the edge of the belt linking these pulleys to be turned under. This eventually causes the belt to tear apart. This alignment problem exists on both PAR and both ACODAC systems. It will be corrected by adjusting the position of the motor pulley with respect to the drive pulley. After verifying that pulley alignment is no longer a source of trouble, a test will be run to determine the effects of stress on the belts under operating conditions. These tests will consist of making visual inspections of the belts before, during, and after operation in an environmental test chamber. The visual inspection will be made using the technique or one similar to that outlined by Jim Snodgrass in paragraph 8.5 of his "Report to Chairman of MSAG III" dated February 1978.

#### A.4

##### Spare Parts

All spare parts for the PAR and ACODAC systems will be tested to verify their operational capabilities. All spare boards for the PAR system will be substituted into an operating system and placed in the environmental test chamber for reliability testing. An inventory of spare boards for the ACODAC systems will be made. These boards will be checked to verify that they will operate in the system in a manner identical to the board which they are designed to replace. Spare boards will be manufactured as necessary in order to provide one spare for each board in each system.



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# Declassified LRAPP Documents

Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
Unavailable	Unavailable	SELF-TENSIONING ACOUSTICAL HORIZONTAL LINE ARRAY (SPRAY) DATA ANALYSIS. FINAL REPORT OF BEARING STAKE TESTS JANUARY THRU MARCH 1977.	Sanders Associates, Inc.	790109	ADC017579	U
ARL/TR7924	Mitchell, S. K., et al.	VOLUME IVB. DATA POINTS 10, 11 AND 12 RAW DATA ANALYSIS OF ACOUSTIC BOTTOM INTERACTION IN BEARING STAKE (U)	University of Texas, Applied Research Laboratories	790223	ADE001369; NS; ND	U
TIU1886502F	Eichenberger, D.	REPORT FOR CHURCH STROKE II OCEANOGRAPHIC SERVICES	Texas Instruments, Inc.	790326	ADB036751; ND	U
Unavailable	Unavailable	FINAL REPORT, 1 NOVEMBER 1976-31 DECEMBER 1978	Xonics, Inc.	790430	ADB037987	U
Unavailable	Mitchell, T. M.	PREMOBILIZATION OF R/V INDIAN SEAL	Texas Instruments, Inc.	790531	ADB039703	U
Unavailable	Hays, E. E.	ACODAC AMBIENT NOISE PROGRAM	Woods Hole Oceanographic Institution	790601	ADB040404	U
LRAPPR79029	Unavailable	INTRODUCTION TO THE LRAPP ENVIRONMENTAL-ACOUSTIC DATA BANK (U)	Naval Ocean R&D Activity	790601	ADB041066; NS	U
USRD NO. 4807	Unavailable	MEASUREMENTS ON AQUADYNE MODEL AQ-1 ELEMENTS FOR THE UPGRADED LAMBDA ARRAY	Naval Research Laboratory	790802	ND	U
Unavailable	Ellis, G. E.	SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA ANALYSIS	University of Texas, Applied Research Laboratories	790814	ADA073876	U
BR U0048-9C2	Unavailable	TAP III FINAL REPORT (U)	Bunker-Ramo Corp. Electronic Systems Division	790901	ND	U
OR/ITR1245	Moses, E. J.	OPTIONS, REQUIREMENTS, AND RECOMMENDATIONS FOR AN LRAPP ACOUSTIC ARRAY PERFORMANCE MODEL (U)	ORI, Inc.	790917	NS; ND	U
Unavailable	Colborn, J. G., et al.	EVALUATION OF STANDARD OCEAN CANDIDATES	Pacific-Sierra Research Corp.	800301	ADA087304	U
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Unavailable	Wilson, J. H.	WIND-GENERATED NOISE MODELING	Science Applications, Inc.	810401	ADA190143	U
Unavailable	Goit, E. H.	TOWED ARRAY PERFORMANCE PREDICTION SYSTEM - VERSION 1.2	Science Applications, Inc.	810701	ADB059397	U
3	Unavailable	FINAL REPORT	University of Texas, Applied Research Laboratories	810721	ND	U